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Do Social Cues Raise Snack Intentions?

An EMA Investigation of Momentary Control

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Abstract (German)

Soziale Situationen , etwa das Beobachten anderer beim Verzehr ungesunder Snacks (ziel-inkongruente soziale Reize), können die Ernährungs-Selbstregulation beeinträchtigen, indem sie Versuchungen verstärken und die Konsistenz zwischen Intention und Verhalten schwächen. Wahrgenommene Verhaltenskontrolle (Perceived Behavioral Control, PBC) gilt als potenzieller Schutzfaktor, doch bislang ist unklar, wie diese Prozesse im Alltag auf situativer Ebene ablaufen. Die vorliegende Studie untersuchte, (a) ob die Erwartung, andere beim Snacken zu sehen, zu einer höheren Zahl intendierter Snackportionen führt, und (b) ob retrospektiv berichtete soziale Reize die Umsetzung von Intentionen in tatsächliches Verhalten erschweren. Zudem wurde geprüft, ob PBC diese Effekte moderiert. Im Rahmen einer 14-tägigen ökologischen Momentaufzeichnung (EMA) beantworteten 38 Erwachsene (N = 2.409 Beobachtungen; 1.752 Intention-Verhaltens-Paare) täglich fünf kurze Befragungen zu erwarteten und erlebten sozialen Reizen, wahrgenommener Kontrolle, Snackintentionen und tatsächlichem Konsum. Erwartete soziale Reize sagten höhere Snackintentionen vorher (b = 0.52, IRR = 1.68), während retrospektiv berichtete soziale Reize den tatsächlichen Konsum direkt erhöhten (IRR = 2.58), ohne die Intention-Verhaltens-Beziehung zu moderieren. PBC zeigte kleine, schützende Haupteffekte, milderte den Einfluss sozialer Reize jedoch nicht ab. Die Ergebnisse verdeutlichen, dass soziale Reize auf mehreren Ebenen wirken – sie verstärken sowohl Snackintentionen als auch den tatsächlichen Konsum, unabhängig von der wahrgenommenen Kontrolle. Präventionsmaßnahmen sollten daher stärker soziale Kontexte und Rechtfertigungsprozesse adressieren, um gesundheitsförderliches Essverhalten wirksamer zu unterstützen

Abstract (English)

Social contexts, such as observing others eat unhealthy snacks (goal-incongruent social cues), are known to undermine dietary self-regulation by increasing temptation and weakening intention–behavior consistency. PBC is theorized to buffer such influences, yet little is known about how these processes unfold in daily life at a momentary level. This study examined whether (a) expecting to encounter others eating unhealthy snacks increases intended snack portions, and (b) retrospectively reported social cues weaken the translation of intentions into actual behavior. We further tested whether PBC moderates these effects. Using a 14-day ecological momentary assessment (EMA), 38 adults (N = 2,409 observations; 1,752 intention–behavior pairs) reported five times per day on expected and experienced social cues, perceived control, snack intentions, and actual consumption. Expected social cues predicted stronger intentions to snack (b = 0.52, IRR = 1.68), while retrospective social cues directly increased snack intake (IRR = 2.58) rather than moderating the intention–behavior relationship. PBC showed small protective main effects on intentions and behavior but did not buffer the influence of social cues. These findings demonstrate that goal-incongruent social cues shape eating behavior at multiple stages, by inflating intentions and directly facilitating behavior, independently of perceived control. Interventions should therefore target socially cued contexts and address justification processes, such as self-licensing, that allow goal-incongruent behavior to appear acceptable. Further research is needed to elucidate how momentary self-regulatory capacity and situational temptations interact over short timescales in everyday life.

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Theoretical Background

Unhealthy Eating Patterns and Public Health

Unhealthy dietary habits represent a major global public health concern, substantially contributing to the rise of non-communicable diseases and premature mortality (Bradley et al., 2023; Wang et al., 2020). Within this broader nutritional landscape, snacking has emerged as a particularly critical dietary behavior (Fayet-Moore et al., 2022; Munt et al., 2017). Although snacks can contribute to balanced nutrition when they consist of nutrient-dense options, they are more frequently composed of energy-dense foods that provide little nutritional value, such as sweets, pastries, and salty snacks (Moodie et al., 2013; Njike et al., 2016). In the present study, foods consumed between main meals that meet these criteria are referred to as unhealthy snacks (Elliston et al., 2017). The frequent consumption of unhealthy snacks is an important factor contributing to obesity (Ganpule et al., 2023). Unhealthy snacks are highly accessible, aggressively marketed (Buchanan et al., 2018), and deeply embedded in social routines, which renders them particularly appealing and difficult to resist (Adriaanse et al., 2014; Gardner et al., 2015; Harris & Taillie, 2024). Understanding how situational influences, especially the presence of others consuming unhealthy foods (Elliston et al., 2017; Schüz et al., 2018), shape both snacking intentions and behavior is therefore essential for informing more effective public health interventions (Ganpule et al., 2023; Meng et al., 2025; Njike et al., 2016). Building on this rationale, the present study examines why individuals continue to consume unhealthy snacks despite their health intentions, focusing on momentary social influences and perceived behavioral control as central determinants of the formation and enactment of dietary intentions.

The Intention–Behavior Gap: Theoretical Foundations and EMA Innovations

The ongoing obesity epidemic highlights the persistent difficulty of translating health awareness into sustained behavioral change (Cohen, 2008; Harris & Taillie, 2024). Despite widespread knowledge of the risks associated with unhealthy diets, many individuals struggle to align their everyday eating habits with long-term health goals, a phenomenon widely recognized as the intention–behavior gap (Aulbach et al., 2024; Inauen et al., 2016; Sheeran & Webb, 2016). This gap is particularly pronounced in snacking behavior, where decisions are made quickly and often without deliberate reflection (Cohen, 2008). Snacks are typically consumed in informal and dynamic contexts (Pachucki et al., 2011; Rehman & Sajid, 2022), such as during breaks, social gatherings, or multitasking, conditions that favor impulsive, context-driven eating (Bouwman et al., 2022; Hofmann et al., 2009). Consequently, situational cues and habitual responses frequently override previously formed intentions (Gardner et al., 2015).

Dual-process theories of self-regulation provide a useful framework for understanding this discrepancy. They distinguish between two systems of information processing: an automatic, affect-driven System 1 and a controlled, deliberative System 2 (Hofmann et al., 2009; Kahneman, 2011; Stanovich & West, 2000). Within this framework, Strack and Deutsch's (2004) Reflective–Impulsive Model posits that the Reflective System corresponds to the goal-directed, rational operations of System 2, whereas the Impulsive System captures the associative, automatic responses of System 1. Intention formation typically arises from System 2 processes, in which individuals consciously weigh long-term health goals against immediate gratification (Hofmann et al., 2014; Sharkawi et al., 2021). This reflective process is formalized in the Theory of Planned Behavior (TPB), which proposes that intentions result from attitudes, subjective norms, and perceived behavioral control (PBC) (Ajzen, 1991).

However, the enactment of these intentions often unfolds in real-world contexts dominated by System 1 processes triggered by situational cues.

The Temporal Self-regulation Theory (TST) extends this framework by integrating dual-process mechanisms into a dynamic model of behavior (Hall & Fong, 2015). According to TST, real-time behavior emerges from the interaction of situational cues with habitual tendencies (behavioral prepotency), self-regulatory capacity, and current intentions (Hall & Fong, 2007, 2015). Intentions themselves derive from the perceived value of an outcome and the expectancy that the behavior will achieve it (Hall & Fong, 2015). In the domain of unhealthy snacking, health-oriented intentions may form reflectively, yet enactment frequently occurs under the automatic influence of contextual triggers (Cohen, 2008; Eschenbeck et al., 2016)In such moments, the immediate sensory gratification of unhealthy foods can overshadow the abstract, temporally distant benefits of long-term health. Thus, TST underscores that the intention–behavior gap is not merely a function of motivation but reflects the interplay between internal self-regulatory capacities and the immediacy of external temptations encountered in daily life (Hall & Fong, 2015).

This interaction underscores that failures of self-regulation emerge from momentary mismatches between motivational resources and situational demands(Hall & Fong, 2015; Prinsen et al., 2018). Recent EMA studies have empirically demonstrated how situational factors can override intentions in everyday eating (Aulbach et al., 2024; Elliston et al., 2017). For example, Elliston et al. (2017) asked participants to log each eating or drinking event and respond to 4–5 random prompts daily for two weeks. Their results showed that seeing others eat, experiencing negative affect, and immediate snack availability significantly increased the likelihood of snacking, indicating that discretionary eating is primarily shaped by momentary situational cues rather than by stable, person-level factors such as self-regulation or

intentions. Similarly, Inauen et al. (2016) demonstrated that intentions to avoid unhealthy snacks predicted subsequent behavior only when an individual's momentary intention exceeded their personal average, whereas between-person differences in mean intention levels were non-predictive. These findings emphasize the need to capture not only motivational strength but also within-person fluctuations in intention and snacking behavior through EMA (Aulbach et al., 2024; Inauen et al., 2016).The value of real-time assessment becomes particularly evident given the high frequency and variability of eating episodes throughout the day, retrospective recall of such events leads to substantial bias (Schwarz, 2007). Aulbach et al. (2024) were the first to systematically examine situational influences on the intention–behavior relationship in dietary behavior using high-temporal-resolution EMA data. Their analyses revealed that intentions and consumption co-fluctuate over short intervals of approximately three hours. While stronger intentions generally reduced the likelihood of dietary lapses (Aulbach et al., 2024), situational cues often outweighed intentional control, dynamically shaping the intention–behavior gap. Crucially, these mechanisms became visible only through intensive, real-time assessment, which captured the temporal interplay between stable traits and situational influences (Aulbach et al., 2024).

Although TPB conceptualizes intentions as state-like and context-dependent constructs (Ajzen, 1991), most research still relies on between-person designs and single baseline measures of intention (Elliston et al., 2017; Gardner et al., 2015; Phipps et al., 2023). EMA offers a methodological advancement by addressing this limitation and revealing how psychological constructs such as PBC, self-efficacy, and social influence fluctuate across everyday contexts (Aulbach et al., 2024; Schwarz, 2007). Recent findings highlight that both momentary PBC (Phipps et al., 2023) and exposure to others consuming goal-incongruent foods (Elliston et al., 2017; Schüz et al., 2018) are pivotal determinants of everyday food

choices (Aulbach et al., 2024; Gardner et al., 2015; Webb & Sheeran, 2006). Observing others eat what one intends to avoid can disrupt the translation of dietary intentions into action (Aulbach et al., 2024), potentially because such social cues activate reward expectancies associated with food that may be misinterpreted as genuine hunger (Lutter & Nestler, 2009).

Influence of Goal-Incongruent Social Cues on Intention Formation

In this study, goal-incongruent social cues refer to observable behaviors by others that directly conflict with an individual's dietary goals, for example, seeing others consume unhealthy snacks while one intends to reduce such intake (Aulbach et al., 2024; Elliston et al., 2017). The term goal-incongruent distinguishes these cues from general social eating contexts in which no personal dietary goal is at stake (Cohen, 2008; Harris & Taillie, 2024). Such situations are pervasive, ranging from workplace "cake culture" to hospitality foods at social gatherings, where refusing may feel impolite and thus prompt goal-incongruent intake (Immink et al., 2021; Onufrak et al., 2019). These everyday situations illustrate why goal-incongruent social cues represent a distinct type of social influence that can activate descriptive norms (Reno et al., 1993; Robinson et al., 2014), thereby creating motivational conflict (Cruwys et al., 2015; Hermans et al., 2012).

Drawing on dual-process theory, the anticipation of such cues likely activates the reflective system, prompting individuals to adjust their intentions through deliberate and goal-directed reasoning (Ruddock et al., 2021; Strack & Deutsch, 2004). Hall and Fong (2007) suggest that intentions may change shortly before a behavioral opportunity arises, which helps explain the imperfect correspondence between intentions and subsequent behavior. Experimental evidence supports this anticipatory adjustment: merely expecting to share a meal with others leads individuals to pre-emptively choose larger food portions

compared to when they anticipate eating alone (Ruddock et al., 2021). Even though participants in that study were not dieting, the findings clearly show that anticipating social eating (Ruddock et al., 2021) can increase intended food intake, underscoring the impact of expected social cues on dietary intentions (Higgs, 2015; Mollen et al., 2013).

This dual-process account aligns closely with Social Norm Theory (Reno et al., 1993), which distinguishes between injunctive norms, perceived social approval shaping intentions, and descriptive norms, perceptions of what others typically do, directly guiding behavior (Cruwys et al., 2015; Robinson et al., 2013). Meta-analyses show that in eating contexts, injunctive norms primarily operate at the reflective level, fostering healthier intentions (McDermott et al., 2015; McEachan et al., 2016), whereas descriptive norms exert their strongest influence in real-time eating situations, guiding behavior through automatic alignment with observed group behavior (Cruwys et al., 2015; Hang et al., 2020; McEachan et al., 2016). Empirical studies confirm that social influences shape food-related intentions: both cross-sectional (Stok et al., 2015) and experimental work (Zhou et al., 2023) demonstrate that peer encouragement toward healthy eating can significantly reduce unhealthy snack consumption. However, most research has focused on children and adolescents (Calvert et al., 2024; Rehman & Sajid, 2022; Zhou et al., 2023) or college students (Stok et al., 2015), leaving limited evidence on how these effects operate in adult populations (Veenstra, 2022).

Beyond normative influences, self-licensing (Prinsen et al., 2016, 2018) may also affect intention formation, allowing individuals to flexibly regulate dietary goals in everyday life (Aulbach et al., 2024). Self-licensing refers to generating justifications or “licenses”, that legitimize relaxing one’s goals when anticipating temptations (de Witt Huberts et al., 2014; Prinsen et al., 2016, 2018). For instance, people might reason “I deserved it” or “it’s a special

occasion" to justify indulgence. EMA findings indicate that individuals using such licenses are more likely to indulge initially, as these justifications help reduce internal conflict, especially under strong temptation (Prinsen et al., 2018). Given that goal-incongruent social cues often tempt individuals to abandon dietary goals (Aulbach et al., 2024), they are likely to function as situational licenses, since many justifications for indulgence arise precisely in the presence of others eating (Prinsen et al., 2018). Consequently, people may intentionally loosen their intentions in advance of social situations, aligning planned behavior with anticipated indulgence in a self-consistent way (Aulbach et al., 2024; Prinsen et al., 2013).

Interestingly, high self-licensing opportunity appears to promote initial indulgence but may ultimately support long-term self-regulation by preventing larger self-regulatory breakdowns later (Prinsen et al., 2018). Aulbach et al. (2024) similarly note that tempting food cues do not necessarily undermine intentions if individuals proactively adjust their plans before entering challenging situations. However, because both studies assessed their key variables retrospectively, the presence of social cues in Aulbach et al. (2024) and licensing opportunity or self-regulatory capacity in Prinsen et al. (2018), it remains unclear whether intentions were genuinely adjusted in anticipation of indulgence or whether these justifications were constructed after the behavior had already occurred. A temporally separated design, such as EMA, is therefore crucial to capture these adjustment processes more validly. Moreover, repeated assessment of intentions in EMA designs may itself influence self-regulation, acting as a subtle reminder of long-term goals and prompting proactive planning or preemptive intention adjustment (König et al., 2022; Aulbach et al., 2024). Yet, despite this potential reactivity, there remains a substantial need for further research exploring how digital self-monitoring procedures may shape intention dynamics in dietary contexts (König et al., 2022).

Effect of Goal-Incongruent Social Cues on Behavioral Enactment

While the anticipation of social cues primarily shapes the intention-formation stage (Ruddock et al., 2021), the real challenge for dietary self-regulation often arises during behavioral enactment (Zhou et al., 2023). The actual presence of goal-incongruent social cues can trigger automatic responses of the impulsive system (Bell et al., 2019; Hermans et al., 2012), thereby overriding previously formed intentions (Aulbach et al., 2024). One central mechanism underlying this effect is mimicry, the automatic and unconscious imitation of others' behavior (Chartrand & Bargh, 1999), which in eating contexts manifests as imitating others' consumption of unhealthy snacks (Bischoff et al., 2020; Hermans et al., 2012).

A consistent body of research demonstrates that individuals strongly align their food intake with that of others (Bell et al., 2019; Cruwys et al., 2015; Hermans et al., 2012). In a controlled laboratory study, Hermans et al. (2012) found that participants ate more frequently and in larger quantities when observing others eating, regardless of hunger or prior intentions. Narrative reviews confirm this pattern: people routinely adjust both the amount (Vartanian et al., 2013) and type (Robinson et al., 2013) of snacks they consume to match peers. Typically, participants observed a confederate eating chocolate or M&Ms and subsequently mirrored that behavior (Vartanian et al., 2013). Across such studies, individuals unconsciously align their consumption with perceived group norms (Cruwys et al., 2015; Mollen et al., 2013; Robinson et al., 2013).

The magnitude of these effects depends on contextual and personal factors, such as identification with the reference group (Cruwys et al., 2015), hunger, gender (Suwalska & Bogdański, 2021), body weight (Derricks et al., 2023), or perceived group membership (Higgs, 2015). Participants also tend to prefer unhealthy options when they perceive them as normative (Higgs, 2015). Experimental field evidence further illustrates this normative

power: in a randomized controlled trial, young adults exposed to the descriptive-norm message “Most students eat only one portion of junk food per day” consumed about 28 % fewer unhealthy snacks compared to controls (Robinson et al., 2013). Likewise, Mollen et al. (2013) showed that normative cafeteria messages shaped behavior, with students choosing more burgers under an unhealthy norm and healthier meals under a healthy one. These findings suggest that expectations about what others eat, especially descriptive norms (McEachan et al., 2016) can guide food intake in both experimental (Robinson et al., 2013) and real-world contexts (Mollen et al., 2013).

However, most evidence on socially influenced eating and mimicry comes from tightly controlled laboratory paradigms (Hermans et al., 2012; Vartanian et al., 2013). While valuable for isolating causal mechanisms, such settings lack ecological validity because spontaneous social influences are not captured in real time, limiting the generalizability of findings to everyday eating contexts (Bell et al., 2019; Hermans et al., 2012). EMA designs address this limitation by capturing social contexts as they naturally occur. Schüz et al. (2018), for instance, examined predictors of eating episodes across daily life and found that observing others eat increased the odds of snacking up to fivefold (OR = 5.23). Likewise, Elliston et al. (2017) demonstrated that the presence of others eating nearly tripled the likelihood of snacking (OR ≈ 2.9–4.0). Building on these findings, Aulbach et al. (2024) used intensive EMA sampling, five prompts per day, assessing both context and dietary intentions and found that goal-incongruent social cues not only increased the risk of dietary lapses but also the extent of indulgence, that is, eating more than intended. Although stronger intentions generally reduced lapse probability, the results underscored that situational factors can override intentional control, shaping the intention–behavior gap in real time (Aulbach et al., 2024; Schüz et al., 2018). Both EMA findings and dual-process models (Strack & Deutsch,

2004), suggest that failures of self-regulation cannot be explained by situational factors alone. Motivational capacities such as PBC play a crucial role, not only in behavior enactment but also in the formation of intentions (Hofmann et al., 2014; Lambert et al., 2020; Liu et al., 2021; McDermott et al., 2015). This interaction highlights that self-regulation failures often arise from momentary mismatches between motivational resources and situational demands, emphasizing the importance of capturing both dynamic fluctuations in PBC and the immediate influence of social cues in daily eating contexts.

Expected Perceived Behavioral Control on Intention Formation

PBC describes an individual's belief in their ability to perform a specific behavior under anticipated conditions, considering both personal resources and situational barriers (Ajzen, 1991, 2002). Even when a behavior aligns with long-term goals, individuals may not form corresponding intentions if they doubt their ability to execute it effectively(Hall & Fong, 2015; Martinez & Lewis, 2016; Mullan & Xavier, 2013).

To delineate its conceptual boundaries, PBC can be distinguished from related constructs within motivational and self-regulation research. Unlike self-efficacy, which refers solely to internal competence (Bandura, 1977), PBC additionally encompasses perceived external constraints that may facilitate or hinder performance (Ajzen, 1991). In contrast to locus of control, which reflects a trait-like generalized expectancy about control, PBC is context-specific and behavior-focused (Ajzen, 2002). Compared with the objectively measurable self-regulatory capacity described in TST, PBC represents a subjective evaluation of one's controllability under real-world conditions (Evans et al., 2017; Hall & Fong, 2015).

Within the TPB, PBC is considered a central predictor of intention (Ajzen, 1991). A meta-analysis of 43 observational studies on dietary behaviors, including snack and soda consumption, showed that PBC was strongly associated with intention, second only to

attitudes (McDermott et al., 2015). Lambert, Chang, and Mann (2020) found similar results among U.S. college students, demonstrating that PBC significantly predicted intentions to choose healthy snacks (B= .18, p < .001). Specifically, lower PBC, stemming from perceived lack of ability, affordability, or access, partly explained weaker intentions, particularly among African American students.

The formation of intentions regarding unhealthy snacking is thus multi-causal: both PBC and subjective norms, especially peers' expectations and modeling behavior, jointly shape intentions (Rehman & Sajid, 2022). Adolescents, for example, often adjust their intentions to conform with peer norms to maintain social acceptance (Stok et al., 2015; Zhou et al., 2023). Empirical evidence further indicates that social pressure and peer influence can predict intentions beyond individual PBC (Rehman & Sajid, 2022).

Although extensive research confirms the separate influence of social norms and PBC on intention, their interactive effects in everyday contexts remain underexplored. Findings from other behavioral domains, such as voting, recycling, and energy conservation, suggest that PBC moderates the impact of social norms. Social cues exert stronger influence when PBC is low, whereas high PBC buffers individuals against normative pressure (La Barbera & Ajzen, 2020). While these studies did not examine dietary behaviors directly, they provide valuable theoretical and empirical support for the idea that PBC functions as a context-sensitive construct shaping how social cues affect intention formation.

In line with TST, this perspective positions PBC as a dynamic, forward-looking appraisal of one's ability to act according to one's intentions under anticipated conditions (Hall & Fong, 2015). Consequently, when individuals expect to be exposed to goal-incongruent social cues, such anticipation may lower their PBC and weaken dietary intentions. Conversely, high expected PBC allows individuals to maintain strong intentions

even when temptations are likely, as they feel confident in their capacity to resist. Thus, fluctuating PBC may serve as a regulatory mechanism through which anticipated situational barriers, such as social cues, are integrated directly into the intention formation process. Although this assumption is theoretically plausible (Hall & Fong, 2015; Hofmann, Friese, & Strack, 2009), empirical evidence within everyday dietary contexts is still scarce.

Retrospective PBC: a fluctuating Moderator

PBC not only influences intentions but can also moderate behavioral enactment (Hagger et al., 2022; Phipps et al., 2023). A meta-analysis on health behaviors found a small yet consistent moderation of the intention–behavior link by PBC, though effect sizes varied (Hagger et al., 2022; Lo Dato et al., 2025). Phipps et al. (2023) further showed that adolescents' intentions to reduce sugar intake predicted actual behavior only when PBC was high. While this underscores PBC's relevance for bridging intention and behavior, most studies still treat it as a static construct, measured long before the behavior, sometimes days later (Gardner et al., 2015; Phipps et al., 2023) or cross-sectionally (Lambert et al., 2020). Such designs overlook short-term, within-person fluctuations crucial for understanding real-time self-regulation in daily eating (Ajzen, 1991; Cui-Ping & Yong-Hong, 2011). EMA research in other domains supports the dynamic nature of PBC. Momentary PBC predicted sedentary behavior (Ebrahimian et al., 2022) and sleep regulation (Mead & Irish, 2021) more accurately than trait measures. Related constructs in eating research also fluctuate substantially across the day: inhibitory control predicted snacking and binge episodes (Smith et al., 2020), and self-efficacy decreased before dietary lapses (Schumacher et al., 2018).

An EMA study using the TST framework found that while self-regulatory capacity explained stable between-person differences in snack intake, momentary social cues were stronger predictors of when people actually snacked (Elliston et al., 2017). This likely reflects

that self-regulatory capacity was measured only once, failing to capture its intraindividual variability (Elliston et al., 2017; Hall & Fong, 2015). Such fluctuations may be key for understanding momentary eating behavior (Aulbach et al., 2024; Schüz et al., 2018).

Similarly, Prinsen et al. (2016, 2018) found that situations offering self-licensing opportunities were associated with higher perceived self-regulatory ability, but only when temptations were resisted or indulged to a low degree. This suggests that having justifications available can help people interpret minor indulgences as acceptable exceptions rather than as self-regulation failures. The authors proposed that this conflict-resolving function of self-licensing may protect one's perception of being an effective self-regulator, especially after small lapses. However, Prinsen et al. (2018) also emphasized that this effect did not hold for strong indulgences and may even reverse when people realize they "tricked themselves again," potentially lowering perceived control. Moreover, since perceived self-regulatory ability and behavior were reported at the same time point, causal direction remains uncertain. It is possible that higher perceived control facilitated resistance, but it could also have been reported as a rationalization after success. Nonetheless, their analysis showed that higher perceived self-regulatory ability predicted lower subsequent temptation enactment, indicating that momentary feelings of control may help prevent later lapses.

Taken together, these findings highlight the need for temporally fine-grained assessments of both goal-incongruent social cues and PBC to clarify their roles not only as predictors of intention but as dynamic moderators of the intention–behavior relationship. This remains a crucial research gap, particularly since snacking is highly context-dependent (Cohen & Babey, 2012; Elliston et al., 2017) and occurs multiple times per day (Aulbach et al., 2024; Schüz et al., 2018). Social cues, in particular, exert a powerful influence on real-

world eating behavior (Aulbach et al., 2024; Elliston et al., 2017; see also Higgs, 2015; Schüz et al., 2018).

The Present Study

Despite extensive research demonstrating that social eating cues may influence behavior in multiple ways, serving as anticipated temptations (Ruddock et al., 2021), offering justifications for goal-incongruent choices (Prinsen et al., 2018), and exerting direct effects through social norms (Higgs, 2015; Mollen et al., 2013) or automatic imitation processes (Cruwys et al., 2015; Hermans et al., 2012; Vartanian et al., 2013), it remains unclear how the effect of goal-incongruent social cues is influenced by momentary fluctuations in PBC. Although PBC has often been shown to predict intention (Lambert et al., 2020; Monds et al., 2016), evidence regarding its moderating role in the intention–behavior relationship remains heterogeneous (Hagger et al., 2022), with some studies finding significant moderation (Phipps et al., 2023) and others reporting non-significant results (Gardner et al., 2015; Lo Dato et al., 2025; McDermott et al., 2015). These inconsistencies may stem from the predominant use of static, trait-based assessments of PBC (Ajzen, 1991). Even if there is a strong theoretical rationale for assessing PBC as a state variable (Hall & Fong, 2015), previous studies in the dietary context (Elliston et al., 2017; Schüz et al., 2018) have typically failed to capture the influence of real-time interplay between momentary PBC (Aulbach et al., 2024) and exposure to goal-incongruent social cues in everyday unhealthy snacking (Inauen et al., 2016).To address this gap, the present study implements EMA, enabling real-time tracking of PBC and goal-incongruent social cues and their influence on the intention-behavior relationship, which is operationalized by precisely measuring planned and actual portions of unhealthy snacks. Through independent and temporally linked assessments of intention and behavior, this design allows direct analysis of (a) whether individuals

proactively adjust their snack intentions in anticipation of social temptation or expected PBC, a process that has remained invisible in prior studies relying solely on retrospective assessments (Aulbach et al., 2024; Prinsen et al., 2018) and (b) whether retrospectively reported exposure to goal-incongruent social cues, in conjunction with retrospective PBC, moderates the intention–behavior relationship in unhealthy snacking behavior. Accordingly, the study investigates two main research questions, each accompanied by two corresponding hypotheses:

To what extent do expect goal-incongruent social cues increase the intended number of unhealthy snack portions at the planning stage, and does expected PBC buffer this effect?

H1a: The expectation of being surrounded by others consuming unhealthy snacks predicts a higher number of intended snack portions.

H1b: The effect of expected social cues on intended portions is moderated by anticipated PBC.

To what extent do retrospectively reported social cues weaken the intention–behavior relationship, and is this disruption moderated by retrospective PBC?

H2a: Retrospectively reported goal-incongruent social cues weaken the link between intention and actual snack intake.

H2b: Higher retrospective PBC buffers the disruptive effect of social cues on the intention–behavior relationship

Methods

This thesis is based on a subset of variables and observations from the university project *Ernährungsabsichten im Alltag* (Everyday Dietary Intentions; PI Dr. Alea Ruf, Department of Psychology). The study was preregistered in the internal project registry of the Health Psychology unit prior to data analysis (Ruf et al., 2024). All study materials, datasets, and analysis scripts are archived within this registry. Ethical approval was obtained from the Ethics Committee of the University of Vienna

Study Design

This was a smartphone-based EMA study using an intensive longitudinal, observational design. Participants completed app based self-reports on 14 consecutive days. Each day comprised five time-contingent prompts between 09:00 and 21:00, to capture diurnal patterns, entries were grouped into five 3-hour bins (9–12, 12–15, 15–18, 18–21, 21–24). This study yields a multilevel data structure, with repeated momentary assessments (Level 1) nested within participants (Level 2), allowing for within-person analysis of temporal variation.

Sample Size, Power & Precision

We initially aimed to recruit a convenience sample of 80 participants. This target was based on feasibility, available funding, and the sample size used in a similar study by Aulbach et al. (2024). We monitored prompt-response compliance and sent motivational reminders when an individual's compliance fell below 50%. No formal power analysis was performed, as we lacked prior estimates of expected effect sizes. Ultimately, we recruited 91 participants through multiple channels: the university's internal LABS subject-pool system, announcements on social media platforms (Facebook, Instagram, LinkedIn), and word-of-mouth referrals. We prepared various recruitment materials, including social media posts and

the full listing in the LABS subject-pool system (see Appendix A for examples), to invite potential participants.

To ensure data quality and ethical compliance, we excluded participants who were under 18 years old, had a current or past self-reported eating disorder, reported a Body Mass Index (BMI) below 18.5, lacked sufficient German proficiency, or were pregnant or breastfeeding. In addition, we administered brief screening items on a five-point Likert scale assessing the intention to decrease unhealthy snack intake. Respondents scoring 1 (“strongly disagree”) or 2 (“disagree”) on either item were screened out. Furthermore, following the completion of data collection, participants were excluded from the analytic sample if their compliance rate fell below 50% or if their responses to any EMA item showed no within-person variance.

Compensation for participating in the study was provided in the form of either course credits or monetary incentives. Eligible students received a total of 15 course credits: 1 credit for completing the screening questionnaire and 14 credits for full study participation. Participants not recruited via the university's internal participant pool received €30 as a base compensation, which increased to €40 for those who completed at least 80% of the EMA prompts.

Procedure

Data collection was conducted in November 2024 and January 2025, with a break in December to avoid holiday-related eating bias (Abdulan et al., 2023). Recruitment in January benefited from increased interest due to New Year's resolutions (Cui-Ping & Yong-Hong, 2011). Interested candidates completed an online screening questionnaire (≈ 15 minutes, see Appendix A) for eligibility assessment, sociodemographic information and electronic informed consent. Eligible participants then completed the baseline questionnaire and

received a personalized code. Participants were scheduled for an onboarding call via Zoom, during which they received detailed study instructions and installed the EMA app, M-Path (version 4.4.2, (Mestdagh et al., 2023) on their smartphones. Additionally, all EMA items, including the operational definition and portion sizes for unhealthy snacks were clarified. The onboarding call ended with a brief in-app baseline survey. Afterwards, participants received the onboarding slide deck by email for reference. The 14-day EMA data collection started the next day, with five daily prompts (2–3 minutes per prompt). If the initial notification was missed, a reminder was sent 15 minutes later, followed by a 1-hour response window. On day 15, a short exit questionnaire was completed to assess possible measurement reactivity. Participants were then compensated or, if university credits were requested, a follow-up Zoom confirmation of 2 minutes was conducted.

Measures and Materials

Goal-Incongruent Social Cues

Expected goal incongruent social cues were assessed asking: " Which factors do you expect will make it difficult for you to limit your consumption of unhealthy snacks in the next three hours?". To answer this Item, you can select the following options:

Option 1: „People around me will be eating unhealthy snacks"**,**

Option 2: „People I will be with will be eating unhealthy snacks".

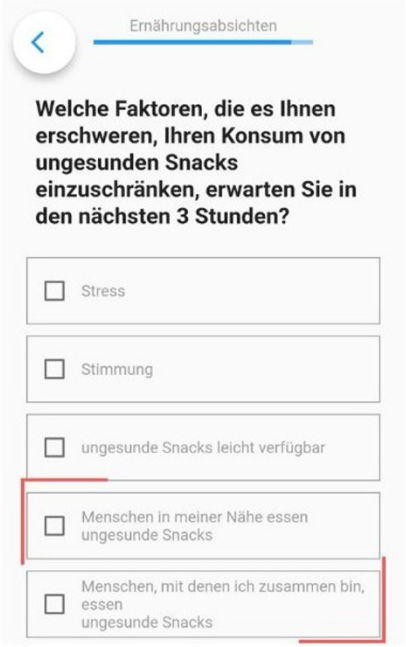
The retrospective presence of goal incongruent social cues was assessed asking. „Which factors made it difficult for you to limit your consumption of unhealthy snacks in the next three hours?". To answer this Item you can choose the following options:

Option 1: „People around me were eating unhealthy snacks".

Option 2: „People I was with were eating unhealthy snacks".

Option 1 captures ambient cues**,** meaning people visibly eating unhealthy snacks in your environment, regardless of whether you chose to be there. Option 2 captures active social exposure**,** meaning you plan to spend time with specific individuals who may influence your snacking. Figure 1 shows how the items got displayed in the App prompt.

Figure
App Prompt for goal-incongruent Social Cues



.

Note. The red boxes indicate the two options for goal-incongruent social cues.

Expected and Retrospective PBC

Expected PBC was measured with the following item: “How much control do you expect to have over how many unhealthy snacks you will eat in the next three hours?” Participants moved the slider to indicate how much control they believed they have over their unhealthy snack intake in the upcoming three-hour window.

Retrospective PBC was captured by asking: “How much control did you have over how many unhealthy snacks you ate in the last three hours?”. Participants moved the slider to

indicate how much control they believed they had over their unhealthy snack intake in the past three-hour window.

The slider used to assess participants' PBC over unhealthy snacking ranged from 0 to 100, where 0 signified "no control at all" and 100 signified "complete control."

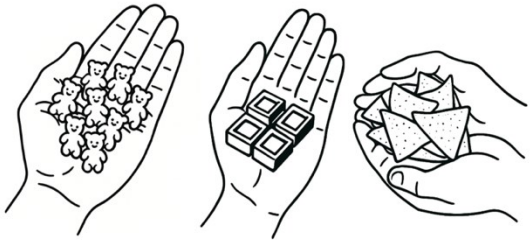
Intention and Behavior of Unhealthy Snacking

Unhealthy snacks were defined as readily available, quickly consumable items typically eaten between meals or as desserts, characterized by high sugar, salt, and/or saturated fat content and low satiating value. This included sweet, salty, or savory snacks such as chocolate, chips, gummy candies, salted nuts, ice cream, and sweet baked goods. In contrast, unsalted nuts, full meals with high sugar or fat content, and sugary beverages were excluded. Participants were given the commonly used threshold of 22.5 g sugar per 100 g (Ogundijo et al., 2021) as a rough guideline for identifying unhealthy snacks.

To standardize reporting of snack amounts, portion sizes were defined based on the physical characteristics of each snack type: a single handful for small items such as gummy bears, a palm-sized amount excluding fingers for flat snacks such as chocolate, and a cupped double-handful for light, voluminous snacks such as chips or popcorn. Figure 2 visualizes the defined portion sizes, depending on the type of snack.

Figure 2

Examples of Unhealthy Snack Portions



Snacking intention was assessed by using the following item: 'How many portions of unhealthy snacks do you plan to eat in the next three hours?'"

The actual snacking behavior was measured by asking: „How many portions of unhealthy snacks did you eat in the past three hours?" Participants reported the number of unhealthy snack portions via a slider ranging from 0 to "5 or more" in 0.5-portion increments.

Statistical Data Analysis

Analyses were conducted in R (R Core Team, 2025) using RStudio 2024.12.1+563.

Data Preparation

Prior to hypothesis testing, all datasets were screened for completeness, consistency with exclusion criteria, and outliers. This process was conducted using the R packages dplyr (Wickham, 2014), tidyr (Wickham et al., 2019) and performance (Lüdecke et al., 2021). Unanswered prompts were excluded from all further analyses to ensure data quality.
To prepare the predictors of interest, binary variables were created for both expected and retrospective goal-incongruent social cues. A value of 1 indicated the (anticipated or reported) presence of others consuming unhealthy snacks, whereas 0 indicated no such cues.

To characterize the sample and key study variables, descriptive statistics were computed, including means, standard deviations, medians, ranges, and relative frequencies. Distributions of core EMA variables were examined through frequency tables and visual inspection of histograms (ggplot2; Wickham, 2016). Skewness and kurtosis were calculated with moments (Komsta & Novomestky, 2022)to assess the distributional properties of continuous variables, informing the specification of suitable statistical models.

Furthermore, intraclass correlation coefficients (ICCs) were calculated to partition variance into between- and within-person components. These estimates served to justify the application of multilevel modeling for subsequent hypothesis testing (Gamer et al., 2019).

Model specification and Diagnostics

To identify the most appropriate modeling approach, four GLMM families were compared: Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial. A summary of the model family comparison results is provided in Appendix B. Based on these evaluations, all final models were estimated using generalized linear mixed-effects models (GLMMs) with a zero-inflated negative binomial (ZINB) distribution, implemented via the glmmTMB package (Brooks, 2017). This choice was theoretically justified, given the overdispersal nature of the count data and the high frequency of zero responses in both intention and behavior outcomes. Each model included random intercepts for participants (Level 2), and random slopes for Level 1 predictors to capture individual differences in within-person effects. To account for temporal patterns in snacking behavior, time of day (prompt number 1-5) and study day were included as fixed control variables in all models.

Model diagnostics were conducted to ensure the robustness of the model specification. Residuals were checked for uniformity and dispersion using DHARMa, and multicollinearity was assessed via variance inflation factors (VIF) using the performance package (Lüdecke et al., 2021). VIFs < 5 indicate no problematic multicollinearity (See Appendix B). For result reporting, fixed-effect estimates, and confidence intervals were extracted and tidied using the broom.mixed and parameters packages. Overall model fit was evaluated using marginal and conditional R^2 values, calculated via MuMIn's r.squaredGLMM() function .

Data Analysis for Hypothesis 1a and 1b

Prior to hypothesis Analysis, expected PBC was person mean centered, and intended snack portions were left in their original metric. For Hypotheses 1a and 1b the dependent

variable is intended portions of unhealthy snacks. For Hypothesis 1a, expected goal-incongruent social cues were included as the main predictor to test whether expected goal incongruent social cues were associated with larger intended snack portions. The model included a fixed effect for expected goal-incongruent social cues and participant-level random intercepts and slopes.

For Hypothesis 1b, we examined whether the effect of expected goal-incongruent social cues on intended snack portions was moderated by expected PBC. Accordingly, the final model included fixed effects, a random slope for social cues, and their interaction term for expected social cues and expected PBC.

Data Analysis for Hypothesis 2a and 2b

To prepare the dataset for Hypotheses 2a and b, the intention reported at one prompt was linked with the actual snack intake reported three hours later, at the following prompt. This pairing procedure resulted in a dataset where each row represented one intention–behavior pair, including retrospective PBC and goal-incongruent social cues. Only complete pairs, that is, those with valid responses for two consecutive alarms within the same day, were retained for analysis. Consequently, at most four pairs could be formed per day. To accurately isolate within-person effects, intention and retrospective PBC were person-mean centered before analysis.

For both Hypotheses 2a and 2b, the dependent variable was the number of unhealthy snacks consumed within the subsequent three-hour window. For H2a, the model included fixed effects for intention, retrospective goal-incongruent social cues, and their interaction, and random effects with random intercepts and a random slope for intention across participants. The zero-inflation component included an intercept only. For H2b, we added retrospective PBC as an additional moderator, specifying a three-way interaction (intention ×

retrospective social cues × retrospective PBC). The random-effects structure again included random intercepts and a random slope for intention, and the zero-inflation part contained an intercept only.

Deviations from Preregistration

Although the preregistration proposed excluding responses with short completion times (Eisele et al., 2021), this step was omitted to preserve ecological validity. Given the naturalistic EMA setting, brief responses were considered plausible and potentially meaningful, as participants often completed prompts during daily activities. Contrary to the preregistered fallback to a two-part hurdle model, the final analyses employed zero-inflated negative binomial GLMMs with an intercept-only inflation term. This approach provided a superior empirical fit and was theoretically more consistent, as frequent zeros in intentions and snack consumption likely reflected goal-congruent behavior rather than a distinct structural process. The preregistration erroneously included a random slope for expected PBC in the model for Hypothesis 1a, which was removed because PBC was not a predictor in that hypothesis. BMI was added to the descriptive statistics for completeness.

Although the preregistration specified maximal random-effects structures (i.e., random intercepts and correlated slopes for all within-person predictors), several of these models failed to converge or produced singular fits, indicating overparameterization. Following best practice recommendations for mixed-effects modeling , we therefore adopted a stepwise model-building approach: starting from a random-intercept baseline model, random slopes were added sequentially and retained only when they improved model fit and converged properly. This procedure yielded a reduced but empirically stable random-effects structure across all hypotheses (see Appendix B). Finally, contrary to the preregistered plan to report

unstandardized regression coefficients (B), all effects are presented as incidence rate ratios (IRR) to facilitate interpretation in the context of count-based outcomes.

Results

Sample and Compliance

Participants were recruited via two channels: 18 individuals (47%) through the university's internal LABS subject pool, and 20 individuals (53%) via external outreach. Participants' mean age was 36.3 years (*SD* = 14.7; range = 19–68). Among the 38 participants, 8 identified as male (21%), 30 as female (79%), and none as diverse. Regarding occupation, 12 were students, 11 were employed full time, 8 were employed part time, 2 were unemployed, 2 were retired, and 3 reported another status. Their BMI ranged from 18.59 to 73.50, with an average of 25.02 (*SD* = 8.74).

A total of 91 participants enrolled and began the EMA protocol, of whom two dropped out during the study. One more participant was excluded due to falling below the predefined compliance threshold of 50%, leaving a sample of 88 participants. An additional 50 were excluded for exhibiting zero within-person variance on one or more focal measures. Zero variance was observed for retrospective PBC (past three hours; *n* = 1), expected PBC next three hours; *n* = 1), actual snack intake (past three hours; *n* = 3), intended snack portions (next three hours*; n* = 5), retrospective goal-incongruent social cues (past three hours; n = 45), and expected goal-incongruent social cues (next three hours; *n* = 32). This yielded a final analytic sample of 38 participants, which was used for all subsequent analyses.

Across all 2,660 EMA prompts, 251 were skipped, leaving 2,409 observations nested within 38 participants. This corresponds to an overall compliance rate of 90.6%. Engagement,

summarized by the number of answered prompts per participant, was high with a mean compliance of 90.6% (*SD* = 7.7%).

Sensitivity checks showed that 2.6% completed < 50 prompts, 86.8% completed 50–69 prompts (≈10–13 days), and 10.5% completed all 70 prompts. No participant fell below 60% compliance. Across all participants, an average of 63.39 prompts (*SD* = 5.42) were answered for hypotheses 1a and 1b, resulting in a total of 2,409 valid prompts. For hypotheses 2a and 2b, a total of 1,752 valid prompt pairs were constructed, which corresponds to an average of 46.43 prompt pairs per participant (*SD* = 7.90).

Intraclass Correlation Coefficients

Intraclass correlation coefficients (ICCs) indicated that a substantial proportion of variance in key study variables occurred at the within-person level. These results highlight that participants' experiences and responses varied substantially across measurement occasions, indicating that multilevel modeling is appropriate to account for the nested data structure. ICCs for all relevant variables are presented in Table 1.

Table
Intraclass Correlation Coefficients (ICC)

Variable	ICC	Between-Person Variance (%)	Within-Person Variance (%)
Intended snack intake	0.50	50.2%	49.8%
Actual snack intake	0.38	38.3%	51.7%
Expected PBC	0.30	29.9%	70.1%
Retrospective PBC	0.27	26.7%	73.3%
Expected goal-incongruent social cues	0.23	23.1%	76.9%
Retrospective goal-incongruent social cues	0.19	19.4%	80.6%

EMA Measures

Snack Intention and Behavior

Overall, across all answered EMA prompts, participants' momentary snack intentions averaged $M = 0.30$ portions ($SD = 0.58$), with a median of 0 portions and a full observed range from 0 to 5 portions. Participants most often reported planning to eat 0 portions of unhealthy snacks (67.8%), followed by 1 portion (13.9%), 0.5 portion (10.9%), 1.5 portions (2.4%), 2 portions (2.3%), 3 portions (1.3%), 3.5 portions (0.5%), 2.5 portions (0.5%), 4 portions (0.3%), 4.5 portions (< 0.1%), and 5+ portions (< 0.1%). The intraclass correlation was ICC = .495 (random intercept by ID). This indicates that about 49.5% of the variance in momentary snack intentions was between participants, with the remainder within participants**,** supporting the use of multilevel modeling.

Actual snack intake showed a similar pattern as snack intention, $M = 0.32$ portions (SD = 0.66), median = 0, range = 0–5. Reports were most often 0 portions (69.3%), followed by 1 portion (12.2%), 0.5 portion (8.2%), 1.5 portions (3.7%), 2 portions (2.9%), 3 portions (1.8%), 2.5 portions (1.4%), 3.5 portions (0.3%), 4 portions (< 0.1%), 4.5 portions (0; 0%), and 5+ portions (0.1%). The ICC was = .400, meaning that 40% of the variance of the actual intake of unhealthy snacks was between participants

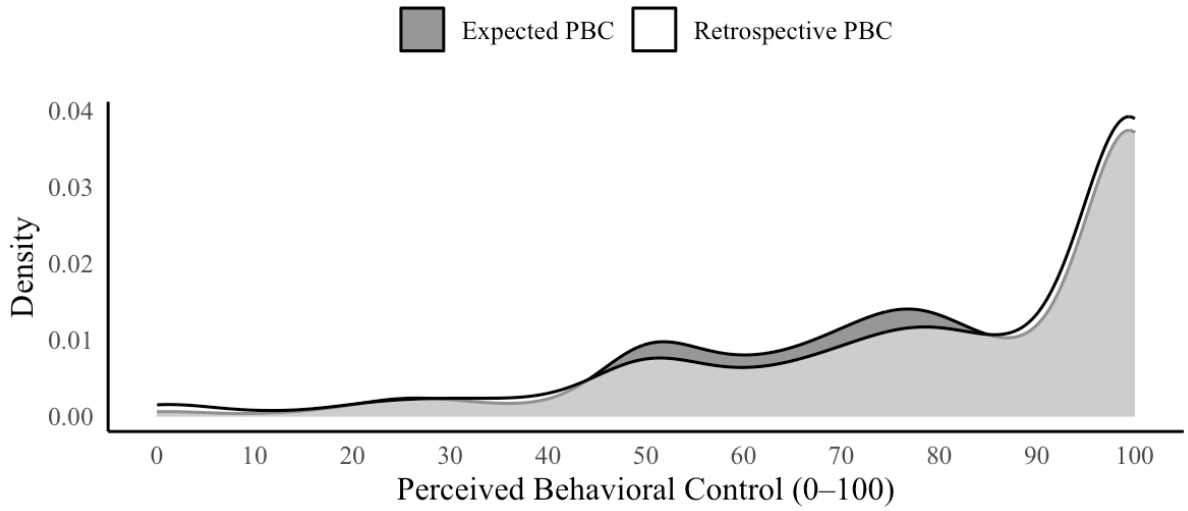
Expected and Retrospective PBC

The average level of PBC was 80.50 ($SD = 23.30$). The median implies that at least half of all momentary expected-PBC ratings were ≥ 89**.** For Retrospective PBC, the average was 80.10 ($SD = 24.40$, range= 0-100). The median indicates that at least half of the momentary retrospective-PBC ratings were ≥ 90. Figure 3 displays the density distributions of expected and retrospective perceived PBC across all answered EMA prompts. As shown,

both distributions were highly right-skewed, with most of the observations clustering near the maximum value (100), indicating an overall high level of PBC.

Figure 3

Density distribution of expected and retrospective PBC across all EMA prompts.



Note. A density curve represents the relative frequency of values across the observed range. The area under each curve equals 1, higher peaks indicate where values are more concentrated.

Expected and Retrospective Goal-Incongruent Social Cues

Across all prompts in the analytic dataset, participants endorsed expected social cues on 482 occasions and retrospective social cues on 269 occasions (total = 751).

Per participant, the number of endorsements averaged 12.70 for expected cues (SD = 10.40; range = 1–42) and 7.08 for retrospective cues (*SD* = 6.34; range = 1–23); combined endorsements averaged 19.84 (*SD* = 15.90; range = 3–65).

In relative terms, participants on average reported expected social cues in 20.2% (SD = 16.8), retrospective social cues in 11.2% (*SD* = 10.0), and any social cue in 31.4% (*SD* = 25.7) of their answered prompts. The median number of prompts for expected goal-incongruent social cues per participant was 10, indicating that half of the participants reported

such cues on 10 or fewer occasions. For retrospective social cues, the median was 5, suggesting that 50% of participants recalled goal-incongruent social cues on five or fewer occasions.

Model Evaluation and Selection

Model diagnostics showed no influential cases and acceptable multicollinearity, with all VIFs below 3.3. Dispersion tests indicated that all models except model H2a met variance assumptions, while model H2a showed significant overdispersion ($p = .008$). Therefore, a negative binomial distribution was used for the behavioral models. Likelihood ratio tests comparing zero-inflated and standard count models confirmed that zero inflation significantly improved model fit in all cases (all $p < .001$).

Nested model comparisons were conducted using AIC, BIC, and likelihood-ratio tests. All models were estimated with zero-inflated negative binomial distributions and random intercepts for participants. Due to convergence problems, the preregistered maximal random-effects structures could not be estimated. Therefore, simplified models with random intercepts and, where appropriate, random slopes for within-person predictors were used instead. For H1b, model fit improved substantially after adding social cues and PBC ($\Delta AIC = -152.6$, $p < .001$). Including their interaction did not further enhance fit ($\Delta AIC = -1.3$, $p = .069$). The final model retained all fixed effects and a random slope for social cues. For H2a, the best-fitting model included intention and retrospective social cues as main effects. The interaction term did not improve fit ($\Delta AIC = +1.9$, $p = .801$) and was omitted.

For H2b, adding PBC significantly improved fit ($\Delta AIC = -121.4$, $p < .001$). The Social Cues × PBC interaction further improved fit ($\Delta AIC = -8.1$, $p = .001$), while the three-way interaction did not ($\Delta AIC = +1.9$, $p = .810$) and caused convergence issues. Thus, all

two-way interactions were retained in the final model. For detailed Results of Model Assumption Checks and Model specification, see Appendix B.

Effects of expected PBC and Goal-incongruent Social Cues on Intention Formation

The following section presents the results of the final models.

Expecting Goal-Incongruent Social Cues Increases Intended Unhealthy Snack Portions

Expecting to be around individuals who consume unhealthy snacks in the next three hours was significantly associated with stronger intentions to snack (β = 0.78, S*E* = 0.12, z = 6.53, $p < .001$, IRR = 2.19). This suggests that on occasions when participants expected exposure to goal-incongruent social cues, their intention to snack was more than twice as high compared to times without such cues. In contrast, the between-person effect, how often participants expected such cues on average across the study period, was not significant (β = 1.21, *SE* = 0.83, z = 1.46, $p = .144$, IRR = 3.37). This indicates that general tendencies to expect social cues were not reliably related to overall snack intentions. The effect of study day (β = -0.01, *SE* = 0.006, z = -1.51, $p = .130$, IRR = 0.99) was also non-significant, suggesting no systematic change in intentions over time. The model explained 8.8% of the variance in snack intentions due to fixed effects (marginal $R^2 = .088$), and 56.5% when accounting for both fixed and random effects (conditional $R^2 = .565$). Diagnostic checks showed that model assumptions were met and the model fit was adequate. The effect stayed significant after controlling for study day and time of day, this applies to all tested models. There was no indication that model assumptions were violated.

Expected PBC Moderates the Impact of Expected Goal-Incongruent Social Cues on Snacking Intention

The hypothesized buffering effect of expected PBC on the influence of expected goal-incongruent social cues was not supported. Although the interaction between expected social

cues and expected PBC reached statistical significance ($\beta = 0.007$, $SE = 0.003$, z = 2.24, $p = .025$), its effect size was minimal and did not indicate a meaningful moderation. The main effect of expected goal-incongruent social cues remained significant, indicating that participants reported stronger intentions to consume unhealthy snacks when anticipating exposure to such cues ($\beta = 0.66$, $SE = 0.12$, $z = 5.65$, $p < .001$).

The between-person effect of average exposure to social cues was not significant ($\beta = 1.03$, $SE = 0.83$, $z = 1.25$, $p = .211$). In contrast, the main effect of expected PBC was significant and negative ($\beta = -0.016$, $SE = 0.002$, $z = -9.69$, $p < .001$), suggesting that participants tended to intend fewer unhealthy snacks on occasions when they perceived greater control over their behavior. The model explained 11.9 % of the variance through fixed effects (marginal $R^2 = .119$) and 58.2 % when including random effects (conditional $R^2 = .582$).

Retrospectively Assessed Goal-Incongruent Social Cues Weaken the Intention–Behavior Relationship

The interaction between retrospectively reported goal-incongruent social cues and snack intentions was not significant ($B = 0.03$, $p = .598$), suggesting no influence on the intention–behavior relationship. However, main effects revealed that momentary snack intentions significantly predicted unhealthy snack intake. Likewise, retrospective goal-incongruent social cues had a significant within-person main effect. In moments when participants retrospectively reported goal-incongruent social cues, their snack consumption was more than 2.5 times higher than in moments without such cues.

Between-person effects were also evident: individuals who generally reported stronger intentions ($B = 0.36$, $p < .001$) and more frequent goal-incongruent cues ($B = 0.80$, $p = .041$, IRR = 2.23) tended to snack more.

The final model accounted for 26.9% of the variance in snack behavior through fixed effects (marginal R^2 = .269), and 53.9% when including both fixed and random effects (conditional R^2 = .539). Detailed results are presented in Table 2.

Table 1

Parameter Hypothesis 2a

Predictor	*B*	*SE*	95% CI	IRR	*p*
Intercept	-1.14	0.15	[-1.44, -0.83]	0.32	< .001***
Intention (centered)	0.15	0.02	[0.11, 0.20]	1.17	< .001***
Retrospective Social Cues (within-person)	0.97	0.14	[0.70, 1.27]	2.64	< .001***
Intention (between-person)	0.36	0.05	[0.26, 0.47]	1.44	< .001***
Retrospective Social Cues (between-person)	0.80	0.39	[0.04, 1.56]	2.23	.041*
Time of day: 12:00–15:00	0.43	0.08	[0.26, 0.60]	1.53	< .001***
Time of day: 15:00–18:00	0.47	0.08	[0.31, 0.64]	1.60	< .001***
Time of day: 18:00–21:00	0.53	0.09	[0.35, 0.71]	1.69	< .001***
Study day	0.02	0.01	[0.01, 0.03]	1.02	.004**
Interaction: Retrospective Social Cues (between-person)	0.03	0.05	[-0.08, 0.13]		.598

Note. *p < .05, **p < .01, ***p < .001; N = 1,752.

Retrospective PBC Reduces the Impact of Goal-Incongruent Social Cues on the Intention–Behavior Relationship

The three-way interaction between snack intention, goal-incongruent social cues, and retrospective PBC was not significant and did not improve model fit($\Delta\chi^2(1) = 2.06$, $p = .151$). Retrospective PBC did not significantly buffer the influence of social cues on the translation of intentions into snack behavior.

However, as shown in Table 3, main effects and two-way interactions were statistically significant. As based on previous models, the main effects of snack intentions and goal-incongruent social cues remained significant, indicating stable positive associations

with snack behavior across models. In contrast, higher levels of retrospective PBC were negatively associated with snack intake, suggesting that individuals who felt more in control were generally less likely to engage in snacking, independent of intentions or situational influences. The interaction between snack intentions and retrospective PBC was not significant, indicating that in this model, retrospective PBC did not moderate the intention-behavior relationship. While the interaction between retrospective PBC and social cues was statistically significant ($p = .003$), visual inspection revealed parallel slopes, suggesting no practical relevance (see Appendix B).

The final model accounted for 19.8% of the variance in snack behavior through fixed effects ($R^2m = .20$), and 52.0% when including both fixed and random effects ($R^2c = .52$). These values indicate that the model explained a substantial portion of between- and within-person variability in daily snack consumption.

Table 2

Parameter Hypothesis 2b

Predictor	*B*	*SE*	95% CI	IRR	*p*
Intercept	-1.52	0.66	[-2.81, -0.23]	0.22	.021*
Intention (centered, within person)	0.19	0.03	[0.13, 0.25]	1.21	< .001***
Retrospective PBC (within-person)	-0.02	0.00	[-0.02, -0.02]	0.98	< .001***
Retrospective social cues (within-person)	0.79	0.10	[0.59, 0.97]	2.20	< .001***
Intention (between-person)	0.58	0.09	[0.40, 0.76]	1.79	< .001***
Retrospective social cues (between-person)	1.28	0.69	[-0.08, 2.64]	3.59	.065
Retrospective PBC (between-person)	-0.00	0.01	[-0.02, 0.01]	1.00	.857
Interactions					
Intention × PBC (within-person)	0.00	0.00	[-0.00, 0.00]	1.00	.125

PBC × Retrospective Social Cues (within-person)	0.01	0.00	[0.00, 0.02]	1.01	.003**
Intention × Retrospective Social Cues (within-person)	-0.02	0.09	[-0.20, 0.16]	0.98	.862

Note. *p < .05, **p < .01, ***p < .001; N = 1,752.

Discussion

This study aimed to clarify how momentary goal-incongruent social cues and PBC influence unhealthy snacking in daily life. Using EMA, we examined whether exposure to others eating unhealthy snacks predicted increases in both intended and actual snack intake, and whether these effects depended on fluctuating PBC. To disentangle their effects on intention formation and behavior, both variables were assessed at two temporal levels. At the point of expectation before potential snacking episodes and as retrospective subsequent momentary reports. Anticipated exposure to goal-incongruent social cues increased intended snack portions, confirming their role in intention formation. Above-average expected PBC showed a general buffering effect on intentions but did not moderate the specific effect of goal-incongruent social cues. At the behavioral level, both retrospective social cues and PBC independently predicted snack intake, but neither moderated the intention–behavior relationship. Importantly, intentions remained a robust within- and between-person predictor of behavior, even when accounting for momentary control and social exposure. Building on these findings, the following section takes a closer look at how expected social cues may function as early-stage triggers by shaping snack-related intentions in advance.

Using Social Cues to Justify Snacking

Interestingly, the influence of expected goal-incongruent social cues already appears to manifest at the level of intention formation (Ruddock et al., 2021). This raises the question of whether such cues act as situational justifications for unhealthy snacking. Self-licensing theory (Prinsen et al., 2018) offers a plausible explanation for this pattern. It posits that individuals resolve conflicts between short-term desires and long-term goals by generating justifications that legitimize goal-incongruent behavior, so-called licenses. Anticipated goal-incongruent social cues, which are often perceived as tempting situations (Aulbach et al., 2024; Randle et al., 2023), may thus function as such licenses, enabling individuals to

preemptively adjust their intentions in favor of indulgence. While our data support the notion of anticipatory intention adjustment, we did not explicitly assess whether participants consciously used expected social cues as justification for indulgence. However, several indicators point in that direction. First, the low frequency of expected goal-incongruent social cues suggests that such occasions could have been experienced as a special occasion. Prior research identified “enjoy a special occasion” as the top reason to eat discretionary snacks (Verhoeven et al., 2015). Often, special occasions such as social gatherings or birthday parties involve people consuming unhealthy snacks (Fahey et al., 2019; Helander et al., 2016; Verhoeven et al., 2015). Therefore, participants may have perceived such occasions as a valid reason to snack (Verhoeven et al., 2015), where temporarily abandoning their dietary goals felt acceptable or even deserved. According to Verhoeven et al. (2015), self-reward is one of the most frequently cited motives for unhealthy snacking. In our sample, the generally low snack intake may have served as a license to indulge occasionally, reflecting a "deserved treat" mindset, consistent with self-licensing mechanisms (Prinsen et al., 2018). Given that restrictive eaters are particularly sensitive to peer influence (Roordink et al., 2023; Verhoeven et al., 2015), situations where others were snacking may have appeared as good opportunities to reward themselves and to avoid the social discomfort of declining a treat. Moreover, people generally prefer eating with others rather than alone (Nakata & Kawai, 2017), as eating together can serve social bonding functions (Hermans et al., 2012; Nakata & Kawai, 2017).

The influence of such social contexts may not require the actual presence of others. Ohshima et al. (2023) showed that even minimal social cues such as seeing oneself eat in a mirror or a static image, can increase taste perceptions and food intake. This suggests that the mere anticipation or mental simulation of a social eating context may serve as social

facilitation (Herman, 2017; Lumeng & Hillman, 2007). Social facilitation describes the phenomenon of increased eating in the presence of others (Herman, 2017). Building on this notion of justification through expected goal-incongruent social cues, the next section explores the role of expected PBC on forming snack intentions.

Expected Social Cues and PBC on Intention

We did not find a buffering effect of expected PBC on the impact of goal-incongruent social cues on intention. Instead, a small positive interaction emerged ($\beta = 0.007$, $p = .025$), but it represented only a 0.7% change in predicted snack portions per one-unit increase in PBC, thus statistically significant, but not practically meaningful.

The main effects revealed that in moments with higher expected PBC than usual, there was a small association with lower intended snack portions. General differences in participants' level of expected PBC didn't affect intention, which highlights the benefit of a state-like assessment. However, goal-incongruent social cues had a stronger impact on intention. Specifically, when participants anticipated such social cues, the number of intended snack portions nearly doubled (IRR = 1.996, $p < .001$), even when controlling for PBC. This suggests that social cues robustly increase snacking intentions, regardless of perceived control in that moment. These findings align with a cross-sectional study by Robinson et al. (2016), who found that individuals with lower self-control were more prone to lapses in goal-directed eating and more likely to conform to perceived peer norms (e.g., consuming sweet pastries). This suggests that social influence can override self-regulatory capacity. Self-licensing may (de Witt Huberts et al., 2014; Prinsen et al., 2018) offer a further explanation. It could be that individuals with high PBC might feel confident enough to deviate from their goals, viewing their behavior as manageable and justified ("I can handle this"). According to

Prinsen et al. (2018), such justifications can protect against self-regulatory failure, especially when indulgences are small and framed as "deserved."

However, this self-image preservation depends on the degree of indulgence and the availability of licenses. While small lapses may sustain perceived control, larger indulgences, even when justified, could result in feeling self-deceived and reduce long-term self-regulatory capacity (Prinsen et al., 2018). This dynamic may be particularly relevant for our sample, which had strong dietary goals and operated in health-conscious social environments (Verhoeven et al., 2015). Importantly, our study did not distinguish between different degrees of indulgence or track follow-up behavior, so it remains unclear whether this protective self-perception was maintained. Ultimately, these results support the idea that social cues influence intentions already during the early planning stage, likely by activating descriptive norms, such as the perception that “others are eating unhealthy snacks” (Higgs, 2015; Mollen et al., 2013). Although we did not directly assess descriptive norms, goal-incongruent social cues may function as a situational proxy for descriptive normative influence (Elliston et al., 2017; Schüz et al., 2018), conveying what is considered typical or appropriate in that moment. The power of such norms lies in their ability to shape behavior even when this contradicts one’s overarching health goals (Polivy & Herman, 2020). Consistent with this, an EMA study in a weight-loss intervention demonstrated that merely communicating eating norms can alter dietary behavior (Manasse et al., 2018). This early normative influence thus appears to operate independently of expected PBC.

No Moderating Role of retrospective Social Cues and PBC of the Intention-Behavior relationship

This study confirmed that retrospective goal-incongruent social cues significantly predict unhealthy snacking in daily life, replicating findings from prior EMA studies (Aulbach et al., 2024; Elliston et al., 2017; Roordink et al., 2023; Schüz et al., 2018). Specifically, these social cues were associated with a 2.58-fold increase in the expected number of snack portions (IRR = 2.58, 95% CI [1.98, 3.36], $p < .001$), which is slightly lower than the three- to fourfold increases reported in earlier research (Schüz et al., 2018). Recent reviews further highlight social contexts as particularly high-risk situations for dietary nonadherence (Randle et al., 2023).

Notably, the effect size of retrospective social cues on actual behavior (IRR = 2.58) was comparable to the influence of anticipated social cues on intentions (IRR = 2.19). This supports dual-process models, which propose that goal-incongruent social cues may shape both the reflective system, which is intention-related (Polivy & Herman, 2020), and the impulsive system, relevant for behavior-related processes (Hermans et al., 2012; Vartanian et al., 2013). The stronger effect of retrospective cues may reflect the additive impact of both anticipated and spontaneously occurring social influences during behavior enactment. Contrary to expectations, higher levels of retrospective PBC did not significantly moderate the effect of social cues or intention on behavior. While above-average PBC generally predicted lower snack intake, this association was not particularly strong. PBC may play a more prominent role in promoting health-supportive behaviors such as choosing fruits, than in preventing unhealthy behaviors, such as unhealthy snacking (McDermott et al., 2015). There was no indication that goal-incongruent social cues widened the intention–behavior gap, nor that PBC buffered this effect. Statistically, this reflects additive rather than

interactive effects: social cues independently increased both intentions and actual behavior. This pattern reduces the observable gap between intended and enacted behavior, suggesting that normative influences already shape decisions during intention formation. This interpretation aligns with dual-process models and recent EMA evidence (Aulbach et al., 2024), emphasizing that environmental cues can simultaneously influence motivational and behavioral systems. Another possible reason for the absence of a buffering PBC effect is that the study did not distinguish between degrees of indulgence or assess whether perceived control was sustained after social eating episodes. According to Prinsen et al. (2018), the consequences of self-licensing depend strongly on the level of indulgence and the availability of justifications. While minor lapses with sufficient justification can preserve self-perceptions of control, more substantial indulgences may lead to a sense of self-deception and reduced perceived self-regulatory capacity. Notably, this broader construct, as conceptualized by Prinsen et al. (2018) includes not only perceived control but also motivation, goal commitment, and self-efficacy. Future studies should consider incorporating these dimensions to better understand the mechanisms through which social cues influence self-regulation.

Methodological Considerations in Assessing Goal-Incongruent Social Cues

The way social cues are operationalized in EMA studies appears to influence their observed effects on dietary behavior significantly. However, the strength of cue-behavior associations may depend on how specifically such cues are assessed. Research using more differentiated measures, such as explicitly asking whether others were seen eating unhealthy foods (Aulbach et al., 2024; Schüz et al., 2018), has consistently reported stronger associations than studies that merely assessed the general presence of others (Carels et al., 2001; Roordink et al., 2023). This highlights the need for nuanced, context-sensitive

assessment strategies in EMA research. Our results also revealed that a substantial portion of the variance in snack intentions stemmed from stable between-person differences. Traits such as susceptibility to social influence or the importance placed on dietary goals may help explain why some individuals are more affected by social cues than others (Rohman et al., 2019). However, our study did not directly assess descriptive or injunctive norms, nor social conformity, limiting our ability to explore these mechanisms in depth.

Additionally, motivational relevance may have influenced cue reporting (Baumeister & Heatherton, 2004). According to Baumeister and Heatherton's (2004) hedonic specificity model, social impulses are only triggered when observed behavior is personally rewarding. Thus, watching someone snack on an unappealing item may not have registered as a meaningful temptation, even if the behavior was noticed. Since we specifically asked about factors that hindered goal implementation, this motivational selectivity may have led to underreporting of social cues that were present but not personally salient.

Limitations

Limitations of this study include the analytical approach, which could not assess the magnitude of deviation from prior intentions or determine whether behavioral lapses occurred. The use of a standard negative binomial model did not distinguish zero-intake occasions from post-lapse episodes or quantify the extent of deviation from planned intake. Consequently, the analysis could not capture how far individuals strayed from their dietary goals or how they responded after potential lapses, key aspects of self-regulatory processes in restrictive eating contexts. Further statistical constraints arose from convergence issues, which required simplified random-effects structures and limited the exploration of between-person variability in reactivity to goal-incongruent social cues. Interpretation of PBC effects was also restricted by ceiling effects: many participants reported near-maximal control (80–

100%), reducing variance and potentially attenuating moderation effects. This pattern may partly reflect a response bias or limited differentiation in self-reports. Likewise, reported goal-incongruent social cues were rare, reducing statistical power despite their theoretical importance. This may partly reflect our sample characteristics: most participants were female, academically educated, and self-selected into a health-focused study. These traits are typically associated with healthier eating habits and more health-conscious social environments(Ball et al., 2010; Bärebring et al., 2020; Christakis & Fowler, 2007) . In such settings, unhealthy eating may be less visible and less normatively accepted, making social cue exposure genuinely rare. Moreover, all social cues were treated as homogeneous, although prior research differentiates between contexts such as friends vs. family or active offers vs. passive observation (Bell et al., 2019; Hermans et al., 2012; Vartanian et al., 2013). Furthermore, we did not control for further influential factors such as habit (Adriaanse et al., 2014; Gardner et al., 2015), behavioral prepotency (Baumeister & Heatherton, 2004), or craving (Reichenberger et al., 2018; Richard et al., 2017). This simplification limits ecological validity and interpretability for intervention design. Finally, the generalizability of the findings is restricted by the small, predominantly female convenience sample (N = 38). As prior work (Prinsen et al., 2018) also relied on female samples, it remains unclear whether similar processes apply to men, among whom social modeling influences may be less pronounced due to gender differences in conformity and self-monitoring. While the present findings provide valuable insights for avoidance-oriented dietary contexts, their transferability to other populations or approach-based eating goals remains to be established.

Strengths

To our knowledge, this study is one of the first to examine the dynamic interplay of social cues, PBC, intentions, and snack behavior in real time using a 14-day EMA approach.

The exceptionally high compliance rate of 90.6%, which exceeds typical EMA adherence levels in health behavior research (Williams et al., 2021), underscores the feasibility of this design and the robustness of the data collected. The data quality is further enhanced by a structured onboarding process, which ensured that participants understood both the EMA items and the definition of unhealthy snacks, thereby minimizing misinterpretations and improving data validity. Importantly, the repeated assessments allowed for the examination of within-person fluctuations across contexts, a key strength over traditional between-subject design. Indeed, ICCs indicated that the majority of variance in PBC, goal-incongruent social cues, intentions, and behavior occurred within individuals, reinforcing the conceptualization of these constructs as context-sensitive, momentary states ratheris than stable traits. This temporal resolution was further enriched by assessing both anticipated and retrospective perceptions of social cues and PBC. Such a dual-timepoint strategy enabled a nuanced analysis of how social cues impact intention formation and behavior enactment at different stages. Finally, this study went beyond global self-reports by using precisely quantified measures of intended and actual snack portions. This operational refinement improves upon previous work (Aulbach et al., 2024) that often relied on vague retrospective estimations.

Theoretical and Further Research Implications

This study refines both TPB and TST by demonstrating that goal-incongruent social cues not only shape intentions but can also directly drive behavior, thereby bypassing the motivational pathway proposed in TPB. Momentary PBC emerged as a fluctuating, context-sensitive state rather than a stable resource, supporting TST's dynamic account of self-regulation. These findings highlight the importance of adopting research designs that capture temporal feedback loops between perceived control, intentions, and behavior. Cross-lagged or dynamic multilevel EMA approaches (Jeune et al., 2025; van Alebeek et al., 2024)

could further elucidate whether goal-congruent actions strengthen subsequent PBC, or conversely, whether lapses, particularly those triggered by social cues, undermine later self-regulatory capacity. Over time, such modeling could clarify how transient losses of control and justification processes like self-licensing accumulate into enduring patterns of healthy or unhealthy eating. In addition, the growing integration of social dynamics into digital environments warrants closer attention. Evidence suggests that social media exposure may amplify social cue effects (van der Bend et al., 2024), with problematic use linked to increased consumption of energy-dense foods (Ayyıldız & Şahin, 2022; Filippone et al., 2022). Future studies should therefore investigate how online goal-incongruent cues, such as images of peers consuming unhealthy snacks, shape intentions and behaviors in real time. Moreover, research should examine how justification processes operate among individuals with high self-regulatory ability and across distinct populations. For instance, individuals with higher BMI appear more reactive to hedonic cues and slower to avoid unhealthy foods (Collantoni et al., 2023). PBC predicted intentions in healthy-weight individuals but not in those with overweight or obesity, suggesting that TPB-based interventions may require tailoring to different populations (Monds et al., 2016). Overall, integrating dynamic self-regulation frameworks with socially and digitally embedded contexts may advance both theoretical precision and practical effectiveness in promoting sustained healthy eating.

Practical Implications

The findings of this study demonstrate that PBC in situations involving goal-incongruent social cues is of limited importance. Simply expecting others to consume unhealthy snacks can increase one's own intention to snack, regardless of PBC. This highlights the need for interventions to promote healthy eating that go beyond strengthening individual willpower and actively address social situations and normative contexts. For

example, interventions in environments such as cafeterias or offices should aim to make healthy eating visible (Casiraghi et al., 2025; Kawa et al., 2023) and establish it as a new social norm (Claassen et al., 2023; Sharps & Robinson, 2016). However, messages must be carefully tested for credibility and fit to avoid boomerang effects, in which healthier individuals lower their standards to align with a less healthy norm (Kuang et al., 2020; Richter, 2018).

In the face of digitalization, digital tools should be developed that constructively instrumentalize the power of social influences. Apps could promote healthy eating decisions and facilitate the implementation of individual dietary goals through making other users' healthy eating choices visible, real-time feedback on social eating situations, gamification elements, and immediate rewards upon goal achievement (Rohde et al., 2019). Because we found snacking to be especially prevalent in the afternoon, preventive efforts should be scheduled to target high-risk times, such as between 15:00 and 18:00 (Roordink et al., 2023). Overall, the success of interventions depends on addressing social and normative influences directly, using context-sensitive timing and tailored strategies, rather than relying solely on the individual’s perceived ability to control their eating behavior.

Conclusion

This study demonstrates the value of EMA for capturing how situational social cues and PBC dynamically interact to shape unhealthy snacking in everyday life. Across two temporal levels, goal-incongruent social cues robustly increased both intended and actual snack intake, indicating that social influences operate not only at the stage of intention formation but also exert a direct effect on behavior. Above-average PBC predicted slightly lower snack intake but did not significantly moderate these effects, suggesting that perceived control functions as a fluctuating, context-sensitive state rather than a stable personal trait. These finding

challenges conventional TPB operationalizations that treat PBC as static and highlights the importance of examining its moment-to-moment variability. Since social cues shaped behavior largely independent of perceived control or prior intentions, interventions should move beyond solely strengthening individual willpower and directly address the social contexts in which eating decisions occur. Public health strategies may be most effective when they promote healthy eating as a visible and socially endorsed norm, whether in cafeterias, workplaces, or digital environments, by making healthy behaviors observable, normative, and socially rewarding. Finally, while the high EMA compliance rate underscores the feasibility and ecological validity of this design, generalizability remains limited by the small, predominantly female, and health-conscious sample, as well as restricted variability in PBC. Future research should examine how social pressure and justification processes unfold in real time and identify intra-individual moderators, such as susceptibility to social influence or self-regulatory fatigue, that determine when social cues erode or amplify self-control. By doing so, EMA research can help clarify the dynamic mechanisms underlying self-regulation and inform the development of context-sensitive interventions that more accurately reflect the social reality of everyday eating behavior.

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List of Abbreviations

PBC= perceived behavioral control

TPB= Theory of Planned Behavior

TST= Temporal Self-Regulation Theory

ICC= Interclass correlation coefficient

List of Tables

Appendix A

Study Materials (Original German Version)

Screening questionnaire (German)
Angaben zu Ihrer Person
Alter: _____ Jahre
Geschlecht:
❑ männlich ❑ weiblich ❑ divers
Höchster Ausbildungsabschluss:
❑ Kein Schul- oder Ausbildungsabschluss
❑ Hauptschulabschluss
❑ Mittlere Reife / Berufsbildende mittlere Schule
❑ Lehre / Ausbildung
❑ Matura / Abitur
❑ Abschluss an einer (Fach-)Hochschule
❑ Promotion
❑ Anderer Abschluss: _____
Wohnsitz:
❑ Österreich
❑ Deutschland
❑ Anderes Land: _____
Aktueller Beschäftigungsstatus:
❑ Student*in
❑ Berufstätig (in Vollzeit)
❑ Berufstätig (in Teilzeit)
❑ Arbeitslos
❑ Im Ruhestand
❑ Anderes: _____
Körperliche Angaben:
Gewicht: _____ kg
Größe: _____ m
Essstörung:
Wurde bei Ihnen eine Essstörung diagnostiziert oder vermuten Sie, an einer Essstörung zu leiden?
❑ Ja ❑ Nein
(Nur wenn weiblich)
Sind Sie aktuell schwanger oder stillen Sie?
❑ Ja ❑ Nein

Appendix B

Model Evaluation, Assumption Checks, and Model Selection

Model family comparisons

Table 3

Model Family Comparison

Hypothesis	Model Family	AIC	BIC	R^2 (marg.)	R^2 (cond.)	Best Fit
H1a (Intention)	Poisson	4584.9	4654.4	.127	.603	
	Negative Binomial	4540.9	4616.1	.145	.591	
	Zero-Inflated Poisson	4516.8	4588.0	.134	.551	
	Zero-Inflated NB	4514.1	4595.2	.120	.601	Retained
Model H1b	Poisson	4584.9	4654.4	.127	.603	
	Negative Binomial	4540.9	4616.1	.145	.591	
	Zero-Inflated Poisson	4515.8	4588.0	.134	.651	
	Zero-Inflated NB	4514.1	4595.2	.120	.561	Retained
Model H2a	Poisson	3943.5	4004.1	.403	.536	
	Negative Binomial	3875.1	3941.2	.399	.505	
	Zero-Inflated Poisson	3864.4	3929.5	.373	.543	
	Zero-Inflated NB	3863.6	3925.3	.355	.520	Retained
Model H2b	Poisson	3787.2	3875.4	.455	.565	
	Negative Binomial	3744.9	3838.5	.461	.555	

Zero-Inflated Poisson	3734.2	3827.8	.470	.608	
Zero-Inflated NB	3732.6	3831.8	.433	.545	Retained

Note. Model families were compared using Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC). The model with the lowest AIC was retained in each hypothesis block. R^2 (marg.) = variance explained by fixed effects; R^2 (cond.) = variance explained including random effects. ZINB = zero-inflated negative binomial distribution.

Model assumption checks

Table 4

Model Assumption Checks for All Models

Model	Dispersion Ratio	p (Dispersion)	p (Zero Inflation)	Max VIF	Influential Cases	Dispersion Result
H1a	0.87	.904	< .001	1.02	_	OK
H1b	0.67	.968	< .001	1.54	_	OK
H2a	0.42	.008	< .001	1.34	_	Overdispersed
H2b	0.46	.096	< .001	3.28	_	OK

Note. Model diagnostics indicated acceptable family.dispersion for all models except H2a, where overdispersion justified the use of a negative binomial

Model specification (Random-effects comparisons)

Table 5

Model Comparisons Predicting Snack Intention (H1a)

Model	Predictors Added	ΔAIC	χ^2 (df)	*p*	R^2(marg)	R^2 (cond)
m0	Baseline: study day, snack window	—	—	—	0.031	0.535
m1	+ Social Cues (within-person)	-52.8	54.83 (1)	< .001	0.051	0.537
m2	+ Social Cues (between-person)	-0.1	1.89 (1)	.169	0.075	0.536
m3	+ Random slope for Social Cues	-19.3	23.26 (2)	< .001	0.088	0.565

Note. ΔAIC = change in Akaike Information Criterion relative to previous model; R^2 (marg) = marginal R^2; R^2 (cond) = conditional R^2; χ^2 = likelihood-ratio test comparing model to previous.

Table 6

Model comparisons predicting snack intention (H1b)

Model	Predictors Added	ΔAIC	χ^2(df)	*p*	R^2 (marg.)	R^2 (cond.)
m_0	Baseline: Study day, Time of day	—	—	—	0.031	0.535
m_1	+ Social Cues (within, between)	−52.7	56.72 (2)	< .001 ***	0.075	0.536
m_2	+ PBC (within, between)	−99.9	103.93 (2)	< .001 ***	0.116	0.558
m_3	+ Social Cues × PBC	−1.3	3.31 (1)	.069	0.120	0.561
m_4	+ Random slope for Social Cues	−15.2	19.15 (2)	< .001 ***	0.128	0.586

Note. ΔAIC = change in Akaike Information Criterion relative to previous model; R^2 (marg) = marginal R^2; R^2 (cond) = conditional R^2; χ^2 = likelihood ratio test comparing model to previous.

Table 7

Model Comparisons Predicting Snack Behavior (H2a)

Model	Predictors Added	ΔAIC	χ^2 (df)	*p*	R^2 (marg)	R^2 (cond)
m0	Baseline: study day, snack window	—	—	—	0.038	0.497
m1	+ Intention (within, between)	-67.6	71.67 (2)	< .001	0.262	0.469
m2	+ Social Cues (within, between)	-89.6	93.54 (2)	< .001	0.355	0.495
m3	+ Intention × Social Cues interaction	+1.9	0.06 (1)	.801	0.355	0.496

Note. ΔAIC = change in Akaike Information Criterion(AIC) relative to previous model; R^2 (marg) = marginal R^2; R^2 (cond) = conditional R^2; χ^2 = likelihood ratio test comparing model to previous. Social Cues = goal- incongruent social cues

Table 8

Model Comparisons Predicting Snack Behavior (H2b)

Model	Predictors Added	ΔAIC	χ^2 (df)	p	R^2 (marg)	R^2 (cond)
m2	Baseline: Intention + Social Cues + Controls	—	—	—	0.355	0.495
m3	+ PBC (within, between)	-121.4	125.43 (2)	< .001	0.429	0.54
m4	+ Intention × Social Cues	+0.9	1.04 (1)	.307	0.429	0.54
m5	+ Intention × PBC	-2.4	4.48 (1)	.034	0.428	0.54
m6	+ Social Cues × PBC	-8.1	10.09 (1)	.001	0.433	0.545
m7	All two-way interactions	0.0	0.00 (0)	1.000	0.433	0.545
m8	+ Intention × Social Cues × PBC	+1.9	0.06 (1)	.810	0.433	0.545

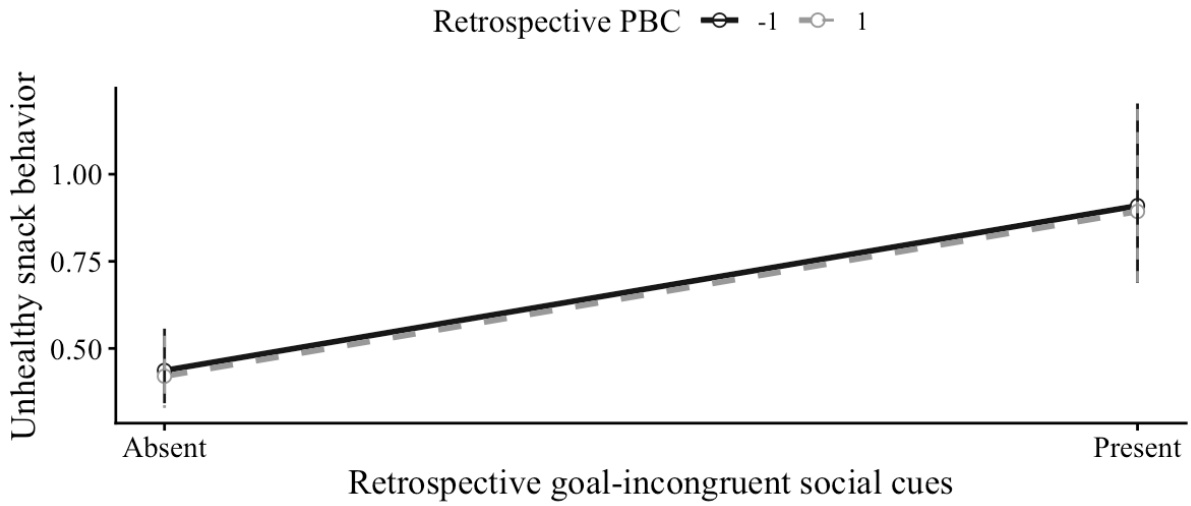
Note. ΔAIC = change in Akaike Information Criterion(AIC) relative to previous model; R^2 (marg) = marginal R^2; R^2 (cond) = conditional R^2; χ^2 = likelihood ratio test comparing model to previous. Social Cues = goal-incongruent social cues

Appendix C

Supplementary Figures and Visualizations

Figure 4

Interaction between retrospective PBC and goal-incongruent social cues on unhealthy snack behavior



Note. The interaction term was statistically significant (p =.003); however, the slopes are nearly parallel, indicating no practical or theoretically meaningful moderation between retrospective PBC and social cues

Figure 5

Distribution of Intended Snack Portions

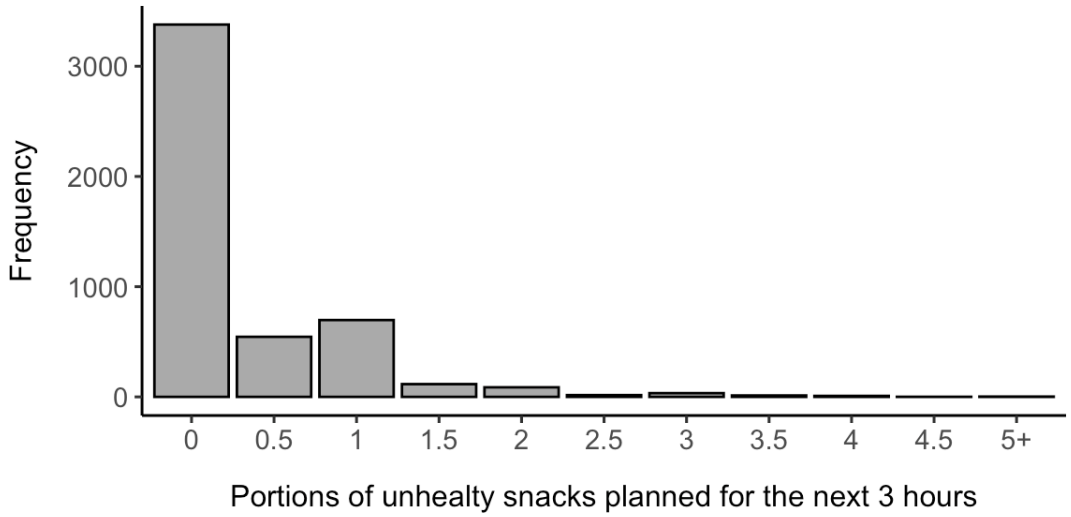
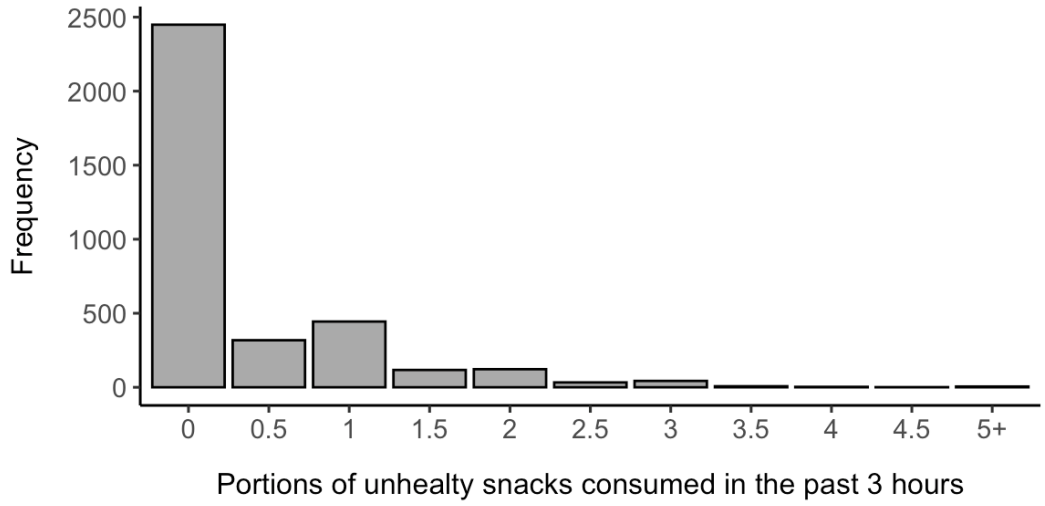


Figure 6

Distribution of Consumed Snack Portions



Appendix D

Declaration of the Use of Artificial Intelligence (German)

Hiermit erkläre ich, dass ich die folgenden KI-Hilfsmittel zur Erstellung meiner Masterarbeit mit dem Titel: **"Do Social Cues raise Snack Intentions? An EMA Investigation of Momentary control"** verwendet habe. Ich versichere, dass die Kennzeichnung der verwendeten KI-Hilfsmittel vollständig ist, inkl. Verwendungszweck, Produktname, als auch ggfs. Prompts und Outputs des KI-Hilfsmittels. Ich verantworte die Auswahl und die Übernahme sämtlicher Ergebnisse der von mir verwendeten KI-Hilfsmittel vollumfänglich selbst.

Verwendungszweck	**Produktname des KI-Hilfsmittels**
Hilfe zur Optimierung von akademischem Englisch, Hilfe beim Coding in R (Fehler codes, code snippets), Prüfung auf formale und grammatikalische Korrektheit, optimierte Formulierungen, Übersetzungleistungen	Chat GPT
Verständnisfragen bei statistischer Analyse, Tipps statistisches Vorgehen	StatsBot (MethodsHub)

Appendix E

Supplementary Materials

Email Templates (German)

The following email templates were used for participant communication throughout the study. They include (a) the invitation to the main study following screening eligibility, (b) a reminder email for participants with low compliance, and (c) a follow-up email providing payment information and the reimbursement form.

(a) Invitation to Main Study Participation

Subject: Terminvorschläge für die Studie „Ernährungsabsichten im Alltag“

Sehr geehrte Teilnehmerin,

vielen Dank für Ihr Interesse an unserer Studie „Ernährungsabsichten im Alltag“ und die Teilnahme an unserem Vorab-Fragebogen. Da Sie die Einschlusskriterien für unsere Studie im Vorab-Fragebogen erfüllt haben, laden wir Sie herzlich ein, am zweiten Teil der Studie teilzunehmen.

Dieser umfasst das Beantworten von Fragen zu Ihren Ernährungsabsichten sowie zu Ihrem Ernährungsverhalten im Alltag mittels unserer Studien-App über einen Zeitraum von 14 Tagen. Ihre Teilnahme an dieser Untersuchung leistet einen wertvollen Beitrag zur Förderung gesunder Ernährungsgewohnheiten.

Bevor Sie mit der Studie in der App beginnen können, erhalten Sie von uns eine Einführung in die App (Installation und Benutzung) sowie weitere Informationen zum Ablauf der Studie. Die Einführung findet über Zoom statt und dauert ca. 30 Minuten. Folgende Termine können wir Ihnen dafür diese Woche anbieten:

- Mittwoch, X. Januar 2025 um 11:00 Uhr
- Donnerstag, X. Januar 2025 um 10:00 Uhr
- Freitag, X. Januar 2025 um 11:00 Uhr

Bitte geben Sie Bescheid, welcher dieser Termine Ihnen am besten passt. Sollte Ihnen keiner der Termine passen, freuen wir uns über Ihre Terminvorschläge.

Mit freundlichen Grüßen
Das Studienteam „Ernährungsabsichten im Alltag“

(b) Template for Low Compliance Reminder

Subject: Reminder: Ihre täglichen Abfragen sind wichtig!

Liebe/r Frau/Herr X,

vielen Dank für Ihre Teilnahme an unserer Studie. Wir wissen Ihre Unterstützung sehr zu schätzen!

Wir haben festgestellt, dass Sie in den letzten Tagen nur wenige Abfragen beantwortet haben. Da die Beantwortung der App-Abfragen ein zentraler Bestandteil unserer Studie ist, möchten wir Sie freundlich daran erinnern, die Abfragen regelmäßig zu beantworten.

Falls es technische Schwierigkeiten oder andere Gründe gibt, die die Teilnahme erschweren, lassen Sie es uns bitte wissen. Wir stehen Ihnen gerne zur Verfügung, um zu helfen.

Vielen Dank für Ihre Mithilfe und Ihr Engagement!

Viele Grüße
Das Studienteam „Ernährungsabsichten im Alltag“

(c) Template for Payment and Reimbursement Form

Subject: Auszahlungsformular – Studie „Ernährungsabsichten im Alltag“

Liebe/r Frau/Herr X,

vielen Dank für Ihre Teilnahme an unserer Studie!

Sie haben mehr/weniger als 80 % unserer App-Abfragen beantwortet und erhalten daher von uns 30 €/40 € für Ihre Teilnahme. Bitte füllen Sie das angehängte Formular aus und schicken es per E-Mail an uns zurück. Das Geld wird Ihnen anschließend zeitnah überwiesen.

Mit freundlichen Grüßen
Das Studienteam „Ernährungsabsichten im Alltag“

Entry in LABS (University’s internal LABS subject-pool system)

Study Name HealthPsych_24WS_Ernährungsabsichten_Teil1

Brief Abstract Mehr Obst und Gemüse, weniger ungesunde Snacks! Ist das auch dein Vorsatz? Dann bist du bei uns goldrichtig.

Teil 1: Onlinefragebogen für 1 Credit

Detailed Description Was wird untersucht?

Die Studie hat das Ziel, herauszufinden, ob und inwiefern Personen ihre Absichten in Bezug auf das Essverhalten im Alltag umsetzen, und erforscht, welche Faktoren die Umsetzung erleichtern bzw. erschweren. Der Fokus liegt hierbei auf den Absichten, weniger ungesunde Snacks und mehr Obst und Gemüse zu essen.

Wie läuft die Studie ab?

(1) Zunächst füllst du einen Onlinefragebogen aus, in dem wir Informationen zu deiner Person und deinem Ernährungsverhalten erfassen. Dort erfährst du, ob du für die Studienteilnahme in Frage kommst. Für das Ausfüllen des ersten Onlinefragebogens (Dauer ca. 15 Minuten) erhältst du 1 Credit.

(2) Kommst du für die Studienteilnahme in Frage, erhältst du den Teilnahmecode für die eigentliche Studie (HealthPsych_24WS_Ernährungsabsichten_Teil2) und vereinbarst zwei Termine mit uns.

(3) Am ersten Termin treffen wir uns online via Zoom, um die Studienapp gemeinsam auf deinem Smartphone zu installieren und Fragen zur Benutzung zu klären (Dauer ca. 30 min).

(4) Danach beantwortest du über einen Zeitraum von 14 Tagen fünfmal täglich einige wenige Fragen in unserer Studienapp zu deinem aktuellen Befinden, deinen Absichten sowie deinen Konsum von ungesunden Snacks sowie Obst und Gemüse. Nach Ablauf der 14 Tage bitten wir dich, noch einmal einen kurzen Fragebogen in der App auszufüllen (Dauer max. 5 Minuten). Für die Teilnahme an der App-basierten Studie erhält du für ca. 3,5 Stunden Zeitaufwand in einem Zeitraum von 16 Tagen zusätzlich 14 Credits.

(5) Am zweiten Termin triffst du dich noch einmal online mit uns (Dauer ca. 2 Minuten), damit wir deine Teilnahme bestätigen und dir die Credits für die App-Teilnahme gutschreiben können.

Eligibility Requirements Die Studie ist für Personen, die aktuell versuchen, weniger ungesunde Snacks und mehr Obst und Gemüse zu essen. Teilnehmende müssen mindestens 18 Jahre alt sein, einen Body-Mass-Index von über 18,5 aufweisen sowie über gute Deutschkenntnisse verfügen und dürfen aktuell nicht schwanger sein oder stillen. Sollten Sie an einer Essstörung leiden, können Sie leider ebenfalls nicht teilnehmen.

Duration 15 Minuten

Credits 1

Study Name HealthPsych_24WS_Ernährungsabsichten_Teil2

Brief Abstract Mehr Obst und Gemüse, weniger ungesunde Snacks! Ist das auch dein Vorsatz? Dann bist du bei uns goldrichtig.

Teil 2: App-basierte Studie für 14 Credits

Die Studie hat das Ziel, herauszufinden, ob und inwiefern Personen ihre Absichten in Bezug auf das Essverhalten im Alltag umsetzen, und erforscht, welche Faktoren die Umsetzung erleichtern bzw. erschweren. Der Fokus liegt hierbei auf den Absichten, weniger ungesunde Snacks und mehr Obst und Gemüse zu essen.

Wie läuft die Studie ab?

(1) Zunächst füllst du einen Onlinefragebogen aus, in dem wir Informationen zu deiner Person und deinem Ernährungsverhalten erfassen. Dort erfährst du, ob du für die Studienteilnahme in Frage kommst. Für das Ausfüllen des ersten Onlinefragebogens (Dauer ca. 15 Minuten) erhältst du 1 Credit. Falls du den Fragebogen noch nicht ausgefüllt hast, suche bitte zunächst nach der Studie „HealthPsych_24WS_Ernährungsabsichten_Teil1“.

(2) Kommst du für die Studienteilnahme in Frage, erhältst du den Teilnahmecode für die eigentliche Studie (HealthPsych_24WS_Ernährungsabsichten_Teil2) und vereinbarst zwei Termine mit uns.

(3) Am ersten Termin treffen wir uns online via Zoom, um die Studienapp gemeinsam auf deinem Smartphone zu installieren und Fragen zur Benutzung zu klären (Dauer ca. 30 min).

(4) Danach beantwortest du über einen Zeitraum von 14 Tagen fünfmal täglich einige wenige Fragen in unserer Studienapp zu deinem aktuellen Befinden, deinen Absichten sowie deinen Konsum von ungesunden Snacks sowie Obst und Gemüse. Nach Ablauf der 14 Tage bitten wir dich, noch einmal einen kurzen Fragebogen in der App auszufüllen (Dauer max. 5 Minuten). Für die Teilnahme an der App-basierten Studie erhält du für ca. 3,5 Stunden Zeitaufwand in einem Zeitraum von 16 Tagen zusätzlich 14 Credits.

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Duration Ca. 3,5 Stunden Credits 14 kannst du mir das so wie auf dem bild audgeben aber ohne so seitenumbruch es soll einfach auf der nächsten seite weiterlaufen